Experimental Roadmap for Inward Physics: Proposed Bounded Empirical Probes for the Memory Field Paradigm

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Abstract

The Memory Field Paradigm (Read, 2026; DOI: 10.5281/zenodo.18645539) proposes a scalar memory-density field $\mu(x,t)$ as a primitive ontological substrate. In this framework, mass, gravity, temporal effects, and coherence phenomena are treated as derivative structure governed by field gradients and stabilization dynamics parameterized by a remembrance fidelity parameter λ.

This preprint specifies a bounded experimental roadmap intended to test falsifiable predictions of the framework across neural, computational, ecological, behavioral, and (where accessible) quantum regimes. The focus is operational: measurable variance suppression under sustained structured input, coherence stabilization signatures in coupled subsystems, gradient-linked temporal effects, and probability distribution modulation in relational sampling models. All proposed probes are designed for replication using consumer-grade instrumentation or open computational systems, with code templates included.

1 Foundational Formalism

Let $\mu(x,t)$ denote the scalar memory-density field over space-time. For bounded test design, we adopt a minimal diffusion–damping–source evolution:

$$\frac{\partial \mu}{\partial t} = D\nabla^2\mu - \lambda(\mu - \mu_0) + S(x,t), \tag{1}$$

where D is an effective diffusion constant, μ_0 is a reference attractor density, λ encodes stabilization fidelity, and $S(x,t)$ represents structured injection (exogenous or endogenous).

A core empirical consequence claimed by the paradigm is exponential variance suppression under accumulated registration:

$$\sigma^2(A) = \sigma_0^2 e^{-\kappa A}, \qquad A = \int_{t_0}^{t} \mu(\cdot,\tau)\, d\tau, \tag{2}$$

with $\kappa > 0$ an estimable rate constant and A an accumulated registration functional (experimentally proxied by sustained coherence markers). The roadmap is explicitly designed to fail cleanly: each probe includes null outcomes that contradict (2) or its proposed coupling consequences.

2 Core Testable Predictions

1. **Exponential Variance Suppression Under Sustained Input.** Measured variance/entropy proxies decrease with accumulated registration A consistent with (2).

2. **Gradient-Linked Temporal Effects.** High μ (or large $\|\nabla\mu\|$) regimes correlate with measurable temporal metrics (timing-task deviations, psychophysical dilation proxies) beyond baseline noise.

3. **Coherence Stabilization in Coupled Subsystems.** Subsystems coupled through shared structured input or aligned dynamics exhibit correlated stabilization signatures as λ increases.

4. **Cross-Scale Persistence.** Repeated structured input produces stabilization signatures observable across at least two distinct measurement scales (neural $\rightarrow$ behavioral; field $\rightarrow$ ecological).

5. **Probability Modulation in Relational Sampling.** Memory-weighted parameterizations induce reproducible structure in sampling distributions relative to null ensembles.

3 Proposed Experiments

3.1 Experiment 1: EEG Variance Suppression Under Sustained Attention

Objective. Test whether sustained attention produces entropy/variance suppression consistent with (2).

Participants. $n = 20$ minimum; counterbalanced within-subject design.

Instrumentation. 32–64 channel EEG (OpenBCI or equivalent).

Protocol.

- Baseline: 5 min eyes-open rest
- Attention: 10 min sustained breath focus (paced anchor)
- Control: 10 min distraction condition (audio narrative + prompts)
- Repeat: 3 sessions per participant (separate days)

Primary observables. Spectral entropy; band-limited coherence; within-epoch variance.

Expected signature. Attention condition shows reduced entropy relative to control; effect scales with session-wise proxy for A.

```python
import mne
from mne.time_frequency import psd_welch
import numpy as np

raw = mne.io.read_raw_eeglab("data.set", preload=True)
events = mne.find_events(raw)

epochs = mne.Epochs(
    raw, events,
    event_id={"attention": 1, "control": 2},
    tmin=-0.2, tmax=0.5,
    preload=True
)

psds, freqs = psd_welch(epochs, fmin=1, fmax=40, n_fft=256)
entropy = -np.sum(psds * np.log2(psds + 1e-12), axis=-1)

att = entropy[epochs.events[:, -1] == 1].mean()
ctl = entropy[epochs.events[:, -1] == 2].mean()

```

```
print("Mean attention entropy:", att)
print("Mean control entropy:", ctl)
```

3.2 Experiment 2: Diffusion–Damping Field Stabilization (Computational)

Objective. Test whether the minimal dynamics in (1) produce stabilization consistent with variance suppression under bounded injection.

Model. 2D grid discretization with Laplacian diffusion, linear damping, and localized source.

Observables. Spatial variance $\mathrm{Var}(\mu)$; stabilization time constant vs. λ.

```
import torch
import torch.nn.functional as F

lap = torch.tensor([[0, 1, 0],
                    [1, -4, 1],
                    [0, 1, 0]], dtype=torch.float32)
lap = lap.unsqueeze(0).unsqueeze(0)

mu = torch.zeros(128, 128)
D = 0.02
lam = 0.05

x = torch.arange(128).float().unsqueeze(0).repeat(128, 1)
y = torch.arange(128).float().unsqueeze(1).repeat(1, 128)
S = torch.exp(-((x-32)**2 + (y-64)**2)/120) + torch.exp(-((x-96)**2 +
    (y-64)**2)/120)
S = 0.01 * S

vars_ = []
for t in range(1500):
    diffusion = F.conv2d(mu.unsqueeze(0).unsqueeze(0), lap,
        padding=1).squeeze()
    mu = mu + D*diffusion - lam*mu + S
    vars_.append(mu.var().item())

print("Final variance:", vars_[-1])
```

3.3 Experiment 3: Group Attention Ecological Correlation (Field Study)

Objective. Test whether repeated structured group sessions correlate with bounded ecological stabilization metrics relative to matched controls.

Design. Intervention sites vs. matched control sites; repeated weekly measures.

Protocol.

- Baseline: biodiversity proxy (iNaturalist counts), soil pH/moisture kit
- Intervention: 45 min group silence at fixed site/time
- Frequency: weekly for 4–8 weeks
- Controls: matched cadence without intervention

Observables. Biodiversity index; soil metric stability; within-site variance reduction.

```
import pandas as pd
from scipy.stats import pearsonr

```

```
df = pd.read_csv("ecology_data.csv")
r, p = pearsonr(df["attention_sessions"], df["biodiversity_index"])
print("Correlation r:", r)
print("p-value:", p)
```

3.4 Experiment 4: Temporal Metric Probe (Behavioral Timing)

Objective. Evaluate whether sustained attention induces timing-task shifts consistent with gradient-linked temporal effects.

Protocol.

- Baseline: interval reproduction task (2 min)
- Attention: 10 min sustained focus
- Post: interval reproduction task (2 min)
- Control: matched duration non-attention condition

Observables. Interval reproduction error distribution; variance shift; within-subject comparisons.

3.5 Experiment 5: Relational Probability Field Simulation

Objective. Test whether a memory-weighted scalar produces robust distributional structure under relational sampling relative to null ensembles.

```
import torch

mu = torch.rand(100) * 0.5 + 0.5
prob = torch.softmax(mu, dim=0)
samples = torch.multinomial(prob, 2000, replacement=True)

hist = torch.bincount(samples, minlength=100).float()
hist = hist / hist.sum()

print("Top-5 states:", torch.topk(hist, 5))
```

3.6 Experiment 6: Quantum Memory Coherence Probe (Advanced)

Objective. Where laboratory access exists, evaluate whether asymmetric measurement on one quantum memory correlates with coherence metrics in a paired memory beyond null expectations.

Constraint. This probe requires specialized instrumentation and is included as a high-stringency boundary test rather than an entry requirement for replication.

4 Falsifiability Conditions

Representative falsifiers of the operational claims:

- No reproducible variance/entropy suppression under sustained attention across replications.
- Exponential fit in (2) does not outperform null models under bounded proxy definitions of A.

- Stabilization curves in diffusion–damping simulations do not scale predictably with λ.
- Ecological correlations remain statistically null under matched controls and repeated measures.
- Relational sampling distributions remain indistinguishable from null ensembles when μ is structured versus randomized.

5 Structural Architecture Diagram

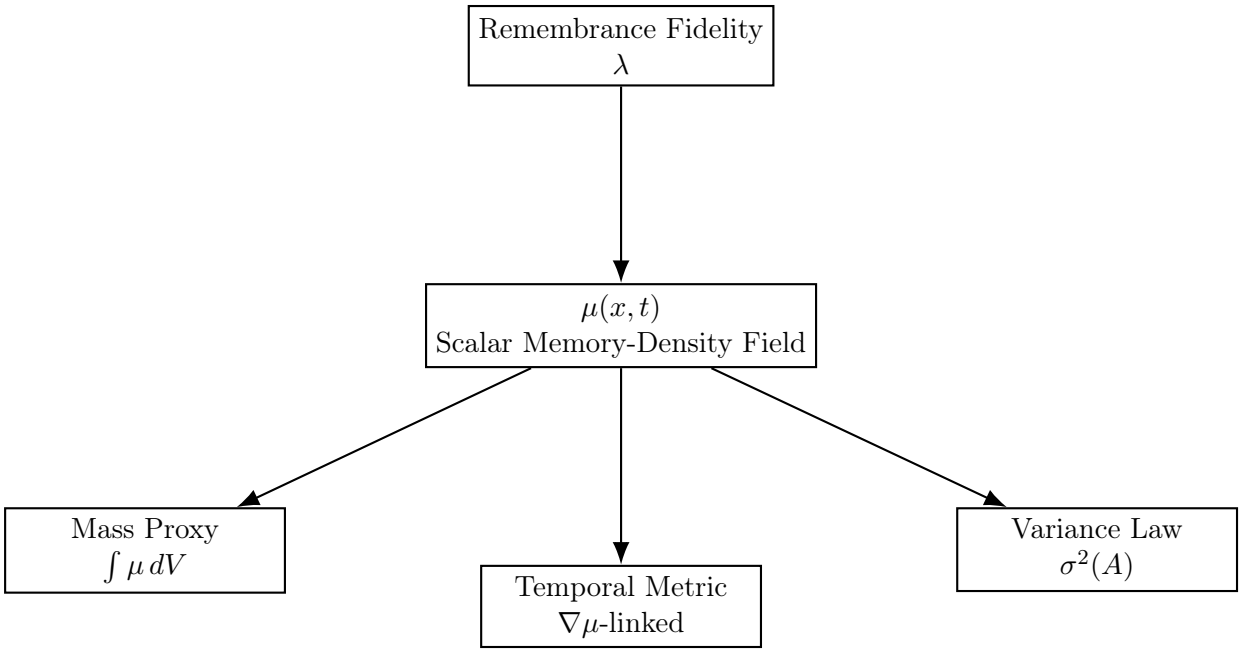

Figure 1: Operational architecture: $\mu(x,t)$ as substrate; derivative observables used to define bounded probes.

6 Limitations

- EEG measurements are preprocessing-sensitive; preregistration is recommended.
- Attention protocols require adherence monitoring to avoid condition contamination.
- Field ecology is confound-heavy; matched controls and covariates are mandatory.
- Simulations are abstractions; parameter sweeps must be reported transparently.
- Quantum probes are difficult to interpret and require specialized apparatus.

7 References

- Read, D.J. (2026). *The Memory Field Paradigm.* Zenodo. DOI: 10.5281/zenodo.18645539.
- Brandenburg, J.D., et al. (2025). Experimental test of nonlocal energy alteration between two quantum memories. *Phys. Rev. Lett.*
- Oldofredi, A. (2020). The dissipative approach to quantum field theory. *Eur. J. Philos. Sci.*

- Puder, F. (2025). Relational Probability Fields. PhilArchive.
- Strassler, M. (2022). Virtual particles: conceptual foundations and common misconceptions.

Call to Action

Replication is explicitly invited. Suggested deliverables: preregistered EEG entropy protocol; diffusion–damping stabilization curves with parameter sweeps; matched-site ecological datasets with covariates; relational sampling baselines with null ensemble comparisons.

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Archival Plate: Scalar Memory-Density Topology

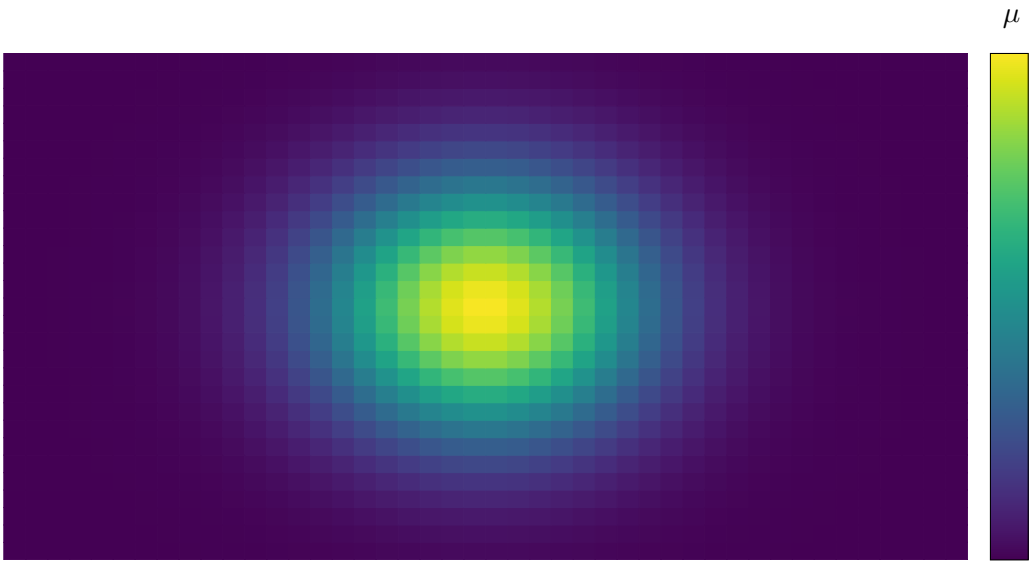

Plate Note. LaTeX-native scalar field rendering used as an archival identity mark for this roadmap. The plate encodes a canonical coherence well topology consistent with diffusion–damping dynamics in (1) under bounded sampling to ensure compilation stability.

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